

NIEHS News

Toxic Waste Research

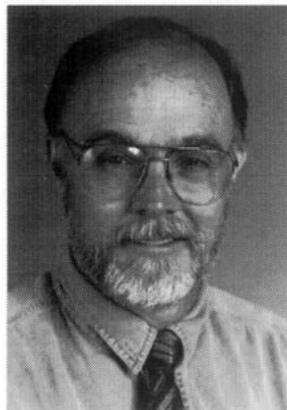
The Superfund Basic Research Program at NIEHS integrates university-based studies designed to produce practical methods to reduce waste and prevent health risks and to generate basic scientific research to produce long-term solutions to hazardous waste problems. The program currently funds more than 1050 scientists on 142 separate research projects at a level of over \$30 million, within 18 programs encompassing 29 universities and institutions around the United States. Federal legislation established the Superfund Program in 1986, and it is scheduled for reauthorization in September 1994.

The NIEHS Superfund Basic Research Program and its constituent university-based programs bring together a wide range of biomedical and non-biomedical disciplines. William A. Suk directs the program as chief of the Chemical Exposures and Molecular Biology Branch within the NIEHS Division of Extramural Research and Training.

"Grants made under this program are for coordinated, multicomponent, interdisciplinary programs, not individual studies," Suk explains. He points out that the grants are comparable to the NIH project program grants in that each university brings together an interdisciplinary team that works within its program, and each university program has a unified theme. Grants are awarded using a rigorous, competitive peer-review process administered by the National Institute of Environmental Health Sciences.

"The program's primary goal," Suk says, "is to bring together expertise from the biomedical sciences, engineering, ecology, and the geosciences to explore the scope of problems of uncontrolled hazardous waste, to seek solutions in carefully developed multidisciplinary collaborations, and to address public health concerns associated with hazardous wastes in the environment."

Suk notes that no other agency provides support for this kind of integrated research. The Superfund Program provides scientific information that is used by state, local, and federal agencies, private and public organizations, and industry to make decisions about the management of hazardous waste.



William A. Suk—Directing development of solutions to hazardous waste problems.

The program also sponsors and organizes conferences that bring together experts from diverse disciplines to discuss specific environmental problems. Conferences have recently been held on biodegradation, transport and interactions of metals, toxic combustion by-products, and pediatric environmental health.

Training science and other health professionals in the many disciplines participating in the university-based programs is an integral part of the NIEHS program. Training ensures continued progress on the hazardous waste problem within various

fields. Some examples of studies and subject areas within the university-based programs include the following:

- Determining if chemicals associated with hazardous waste sites contribute to genetic changes in human populations around the sites,
- Investigating the use of a process called supercritical extraction/wet oxidation to destroy hazardous chemicals bound to soil particles,
- Investigating interactions between microbial populations and toxic metals and focusing on clean-up applications at a highly contaminated Superfund site,
- Monitoring dietary exposure to PCBs from hazardous waste in Mohawk women and children in New York State,
- Developing a technique to measure the accumulation of specific chemicals (porphyrins) in human urine, an accumulation directly attributable to mercury exposure,
- Developing a technique to measure P450 enzymes important in the body's detoxification of environmental chemicals,
- Investigating the link between the common drinking-water contaminant tri-

chloroethylene and a birth defect involving malformation of the heart.

Areas that are the subject of current research and that present special opportunities for expansion include the following:

- Environmental equity—the program is looking at environmental health risks, particularly in children, posed by the fact that Superfund sites may be distributed inequitably across socioeconomic and racial groups.

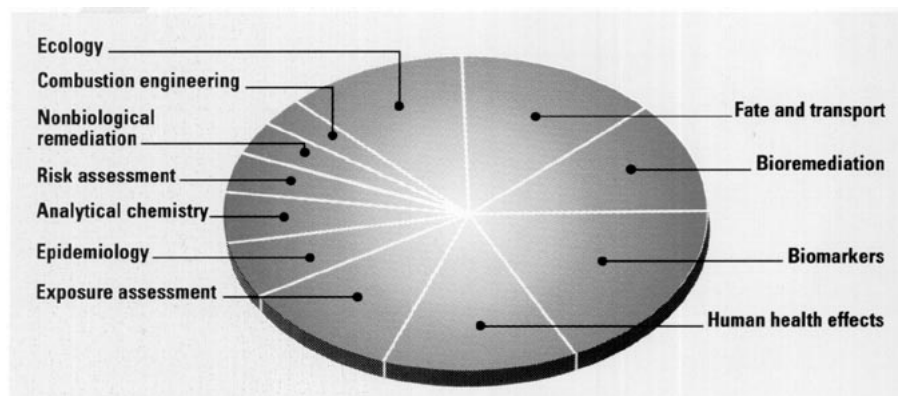
- Ecology—NIEHS funds 27 projects on ecological damage posed by hazardous wastes, on toxic effects on natural succession of ecosystems, and on biodiversity.
- Technology transfer—the program is expanding the ability of researchers to transfer multidisciplinary technology from basic research to applied research and eventually to technology demonstrations and commercialization.

- Prevention of environmentally related disease and dysfunction—the program is conducting research on incineration as a means of waste remediation to include innovative technologies in incineration, health effects of exposure to combustion by-products, and monitoring of incinerator emissions.

The Superfund Program has enabled leading scientists around the country to contribute and collaborate in developing practical solutions to hazardous waste problems. For more information on the NIEHS Superfund Basic Research Program, the research of its grantees, and application procedures, contact William Suk at (919) 541-0797.

Fetal Lead Toxicity

Under an agreement with the National Institutes of Health's Office of Research on Minority Health (ORMH), NIEHS is conducting two key studies on lead toxicity to learn if lead in pregnant women is passed to the fetus. Millions of children in



Superfund Basic Research Categories

the United States have elevated blood lead levels. Because lead poisoning disproportionately affects minorities, the ORMH has joined NIEHS to support research on lead. Funding for these and other lead studies is included in an interagency transfer of \$5 million per year for five years from ORMH to NIEHS.

One of the studies focuses on a unique population of women from Eastern Europe who have migrated to Australia, where they become first-time mothers. Heavily exposed to lead in Europe, these women provide a unique opportunity for this study because of the recognizable differences in the nature of the lead in their bones from European and Australian exposures. In most other populations, the many kinds of lead isotopes in bone and blood make such a study impossible. The study may detect whether (European) lead in bone is mobilized back into the blood during pregnancy and lactation, and whether it is passed to the fetus during pregnancy or to the nursing infant through mother's milk.

An additional aspect of this study will be to determine the turnover rate of lead in bone in children, as well as the contribution of bone lead to blood lead. This is an important aspect of the study because at present there are no published data on the contribution of lead from bone to blood. This information is essential to determine the effectiveness of intervention activities such as soil, dust, and lead-paint abatement and chelation therapy.

A second study will investigate whether lead is mobilized from female skeletal stores during pregnancy and lactation, and if so, how much is mobilized. The multi-phase study uses a colony of cynomolgus monkeys that has documented lead exposures since birth. The first phase validates methodology for analysis of stable isotopes and development of proce-

dures such as X-ray fluorescence. The second phase evaluates the transfer of environmental lead versus maternal body stores of lead to the fetus during gestation. The third phase will determine the relative quantities of lead mobilized from maternal bone and transferred to the fetus during pregnancy. Concurrently, the amount of lead incorporated into fetal tissues as a result of maternal exposure (via ingestion) during pregnancy will also be determined, with the aim of constructing a biokinetic model for maternal/fetal lead transfer.

UNC-Chapel Hill and Duke National Centers for Environmental Clinical Research

NIEHS has recently joined two nationally recognized medical centers to conduct research. Ten-year agreements between NIEHS, the University of North Carolina at Chapel Hill School of Medicine, and Duke University Medical Center, in Durham, North Carolina, have a potential funding of \$30 million to bolster federal research efforts to understand and treat environmentally related diseases and dysfunctions. The contracts make the North Carolina institutions a world center for environmental health sciences clinical research.

Likely areas of collaboration include studies of environmental factors that promote asthma, reproductive dysfunctions,



Meeting of the minds. NIEHS joins UNC-Chapel Hill and Duke University in agreements to conduct environmental clinical research.

disorders of bone, and degenerative neurological diseases. These new collaborations provide NIEHS with a cost-effective, flexible means of melding clinical research and expertise at the universities with the laboratory research ongoing at NIEHS.

UNC and Duke will also help fill a critical need by training physicians and nurses with clinical research experience in disorders linked to the environment.

Stuart Bondurant, dean of the UNC-CH School of Medicine, commented, "This agreement provides a wonderful opportunity for the universities and the federal government to work together on environmental projects, the ultimate goal of which is to improve the health of the public. I envision that the ultimate result of this effort, particularly at a time of limited federal funding for biomedical research, will be far greater than the sum of the individual parts."

Ralph Snyderman, chancellor of the Duke University Medical Center, noted,

NIEHS SUPERFUND RESEARCH PROGRAMS

Massachusetts Institute of Technology
MIT Superfund Hazardous Substances Basic Research Program

Michigan State University
Health Hazards from Groundwater Contamination

New York University Medical Center
Methods to Detect and Predict Human Exposure to Toxic Chemicals

Research Foundation of Southern University of New York at Albany
Multidisciplinary Study of PCBs and PCDFs at a Waste Site

Texas A&M Research Foundation
Procedures to Assess the Hazard of a Superfund Site

University of Arizona
Toxicity, Transport, and Bioremediation at Superfund Sites

University of California, Berkeley
Health Effects of Toxic Substances

University of California, Davis
Biomarkers of Exposure to Hazardous Substances

University of Cincinnati
Microbial Detoxification/Degradation of Hazardous Wastes

University of Washington
Effects-related Biomarkers of Toxic Exposures

Utah State University
Biological Hazardous Waste Management

Harvard School of Public Health
Superfund Toxic Substances: Exposure and Disease

Rutgers State University
Neurotoxicology of Superfund Chemicals

Tulane University
Petrochemical Wastes: Risks and Remediation

University of North Carolina at Chapel Hill
Environmental Fate and Human Exposure to Carcinogens

Colorado State University
Integrated Research on Hazardous Waste Chemical Mixtures

Cornell University
Cornell Superfund Basic Research Program

University of Nevada
Chemical Environmental Problems Associated with Mining

"The NIEHS collaboration provides an opportunity for physicians and patients at the universities to work side by side with some of the country's finest environmental health scientists. Medicine is only beginning to understand the magnitude of the impact environment has on health. This collaboration will allow Duke physicians and researchers from our many medical disciplines to interact with top bench scientists to promote patient care."

Nuclear Site Training

The cleanup of the United States' nuclear weapons complex will be the largest and most costly environmental remediation effort ever undertaken. Estimates are that cleanup in 13 states will take more than 30 years and cost more than \$100 billion. To train workers who will be doing the cleanup, NIEHS has made seven supplemental awards totaling \$10 million to current awardees of the NIEHS Worker Education and Training Program. These awardees are already engaged in training hazardous waste site workers, and they will now broaden their curricula to train those who clean up nuclear waste sites.

The awards are the product of an NIEHS and U.S. Department of Energy interagency agreement to develop model worker safety and health training programs for people involved in waste cleanup activities at facilities in the nuclear weapons complex. Congress authorized and appropriated \$10 million for nuclear site worker training.

This new NIEHS training initiative "will improve efforts to prevent work-related illnesses and injuries, increase the effectiveness of environmental restoration efforts, and complement other programs to protect communities which surround the facilities that make up the nation's nuclear weapons complex," said Kenneth Olden, director of NIEHS.

A DOE suitability study, which was requested by Congress in 1991, found that worker health and safety training under the NIEHS program meets DOE needs, is cost effective, and provides specialized training to meet specific segments of the DOE workforce. Further information about the program can be obtained from NIEHS Worker Education and Training Program at (919)-541-0752.

Silbergeld Receives MacArthur Foundation Grant

A substantial annual salary to pursue the research of your choice is a daydream for most scientists, but for recipients of the MacArthur Foundation "genius" grants, it is a reality. Ellen K. Silbergeld, professor in the

Department of Epidemiology and Preventive Medicine at the University of Maryland Medical School in Baltimore, recently received a five-year MacArthur Foundation grant. Silbergeld has served as an advisor to NIEHS and NTP on numerous scientific policy issues and just completed a four-year term on the National Toxicology Program Board of Scientific Counselors and the NTP Technical Report Review Subcommittee.

The John D. and Catherine T. MacArthur Foundation grants are awarded for a five-year period in a wide range of professional areas including science, the arts, scholarship, and public policy. The foundation makes the awards on the basis of its own research: it is not possible to apply or "campaign" for them. The amounts of the grants vary based on the career level of the recipient; Silbergeld's grant is \$290,000.

Silbergeld's career has been pursued along two parallel tracks, as she has published extensively in scientific journals and has been equally active in policy and environmental advocacy causes. From 1982 until 1991, Silbergeld served as chief toxicologist and director of the Toxic Chemicals Program at the Environmental Defense Fund in Washington, DC.

Silbergeld's research interests include development of a test for lead levels now being patented by the University of Maryland; studies of dioxin as a hormone; studies of fetal brain cells showing that lead levels in males may affect their offspring; studies showing lead stored in women's bones reenters the bloodstream during menopause; and studies investigating the long-term effect of lead on the brain.

Among the advocacy and policy causes she has championed are the phase-out of lead in gasoline; resistance to loosening regulations on carcinogens; incorporating health provisions in Superfund legislation; opposition to the use of mercury to extract gold from the Amazon river; and encouraging a major fast-food chain to switch to paper wrappers from foam containers.

How will Silbergeld direct her considerable talents now that she has a great deal of freedom? "The interests that I will be



Ellen K. Silbergeld—Will use prize to extend scientific research beyond cancer.

pursuing under the MacArthur Foundation grant are the same ones that I was moderately successful in advancing while on the NTP Board," she said recently from her University of Maryland office. "They are to broaden the range of scientific research, testing, and public health concerns beyond cancer. Among these broader concerns are health effects that have critical windows, especially those related to human development, including neurotoxicity and

reproductive effects. Another major concern is with conditions related to the environment that are overly prevalent among disadvantaged populations—conditions which include low birth weight and asthma."

TUFTS Management Fellow Interns at NIEHS

Enhanced prenatal care as a means of preventing or intervening in lead toxicity at the fetal and early childhood stages will be the focus of a year-long fellowship for Marlene Cain Richardson, a graduate student at Tufts University's Department of Civil and Environmental Engineering.

Kenneth Olden, director of NIEHS, is Richardson's mentor in her program as an environmental science and management fellow of the National Urban Fellows, Inc. A major portion of this graduate program for mid-career professionals is to work with a mentor from senior administration at a major environmental organization and to produce a master's thesis from the assignment.

Richardson brings a breadth of experience from her 20 years in management, including six years as an environmental regu-

lator for the government of the District of Columbia. She served as training coordinator for the U.S. Environmental Protection Agency and the U.S. Fish and Wildlife Service. She also worked in public affairs and as a program manager for a major research foundation.

Richardson is especially interested in bridging the gap between scientific knowledge about the environment and human behavioral responses. "Applying scientific knowledge to public policy decisions is one of my career aspirations," she said.



Marlene Cain Richardson—Will focus on prenatal prevention/intervention of lead poisoning.